Sleep Medicine after the pandemic: the new normal

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Introduction to Ancient Greek History

About Professor Donald Kagan

Donald Kagan is Sterling Professor of Classics and History at Yale University. A former dean of Yale College, he received his Ph.D. in 1958 from The Ohio State University. His publications include *The Archidamian War*, *The Peace of Nicias and the Sicilian Expedition*, *Pericles and the Birth of the Athenian Empire*, *On the Origins of War and the Preservation of Peace*, and *The Peloponnesian War*. 
The secret of change is to focus all of your energy, not on fighting the old, but on building the new.
- Socrates

- Pre-pandemic VA ambulatory OSA clinical management pathway
- Accelerated evolution to telemedicine pathway during pandemic
- Expanding HSAT to patients with co-morbid conditions
- REVAMP – a VA web-based platform to improve access to care and improve PAP adherence
- The VA Office of Rural Health TeleSleep program – creating a national sleep network
Veterans Sleep Apnea Treatment Trial

Sleep Clinic Evaluation

- In-lab (split night) polysomnogram
  - AHI < 15
    - Clinic F/U
  - In-lab PSG CPAP titration
    - Set home CPAP to PSG CPAP titration
- Home sleep apnea test
  - AHI < 15
    - In-lab PSG
  - Home APAP titration
    - Set home CPAP to APAP titration

CPAP adherence
Functional Outcomes
Medical Care Cost

Kuna et al. AJRCCM 183:1238-44, 2011.
Functional outcomes with home sleep apnea testing are not clinically inferior to those with in-lab testing.

Kuna et al. AJRCCM 183:1238-44, 2011.
Clinical pathways to diagnose and manage adults with OSA

**In-laboratory**

- Initial In-person
  - In-lab PSG
    - Diagnostic PSG
    - Split PSG
    - AutoCPAP treatment
    - CPAP treatment
  - In-person clinic FU

**Ambulatory**

- Initial in-person
  - Home sleep apnea test (in-person instructions)
  - AutoCPAP with data chip or wireless PAP data
  - In-person clinic FU
Telehealth is a priority of the Veterans Administration
Clinical video teleconferencing (CVT)

Clinical Video Teleconferencing
Exchanging health services live via videoconference between medical facilities
Pre-pandemic hub-spoke network at CMC VAMC
Patient satisfaction with telemedicine clinical management

Phone enrollment (N=60)

- In-person visit (N=28)
  - Home sleep test (in-person set-up) (N=27)
    - APAP ordered (N=21)
      - 1-mo and 3-mo In-person FU (N=20)
  - OSA negative (N=9)
- Video teleconference (N=28)
  - Home sleep test (brochure set-up) (N=28)
    - APAP ordered (N=19)
      - 1-mo and 3-mo video teleconference FU (N=14)

Video teleconference vs in-person OSA care: CPAP adherence and satisfaction

Table 5—Adherence to automatically-adjusting positive airway pressure 3 mo after its initiation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>In-Person Care (n=20)</th>
<th>Telemedicine Care (n=14)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>% days with device usage</td>
<td>54 ± 8</td>
<td>65 ± 8</td>
<td>0.493</td>
</tr>
<tr>
<td>% days ≥ 4 h</td>
<td>39 ± 8</td>
<td>47 ± 9</td>
<td>0.493</td>
</tr>
<tr>
<td>Use, min (all days)</td>
<td>175.6 ± 36.8</td>
<td>220.8 ± 37.5</td>
<td>0.301</td>
</tr>
<tr>
<td>Use, min (days used)</td>
<td>268.9 ± 32.1</td>
<td>305.7 ± 29.9</td>
<td>0.426</td>
</tr>
</tbody>
</table>

Values presented as mean ± standard error.

<table>
<thead>
<tr>
<th>Variable</th>
<th>In-Person Care (n=19)</th>
<th>Telemedicine Care (n=15)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Alliance Index (WAI)</td>
<td>1.70 ± 1.50</td>
<td>5.93 ± 1.77</td>
<td>0.074</td>
</tr>
<tr>
<td>Client Satisfaction (CSQ-8)</td>
<td>0.013 ± 0.48</td>
<td>-0.31 ± 0.57</td>
<td>0.665</td>
</tr>
</tbody>
</table>

Time to Leap Into Sleep Telemedicine?
VA Video Connect teleconferencing (VVC)

Video teleconferencing to patient at home
Exchanging health services live via videoconference to patient’s home computer and mobile devices
The COVID-19 telemedicine pathway

**In-laboratory**
- Initial In-person
  - In-lab PSG
    - Diagnostic PSG
      - AutoCPAP treatment
        - Follow-up in-person clinic
    - Split PSG
      - CPAP treatment

**Ambulatory**
- Initial in-person or clinic video teleconference visit
  - Home sleep apnea test (in-person instructions)
    - AutoCPAP with datachip or wireless PAP data
      - Follow-up in-person or clinic video teleconference visit

**COVID-19 Telemedicine**
- Phone or home video teleconference visit
  - Home sleep apnea test (mailed instructions)
    - Video teleconference autoCPAP set-up with wireless PAP data
      - Phone or home video teleconference visit
Comprehensive management of OSA by telemedicine

In-person pathway (n = 92)
- PSG, HSAT, in-lab PM
- In-person clinic visit with MD
- Non-CPAP (n=52)
  - General measures
- CPAP (n=40)
  - Hospital PSG titration
  - Fixed CPAP pressure
- In-person follow-up with nurse at 3, 6, 12 weeks

Telemedicine pathway (n = 94)
- Three nights HSAT
- Phone +/- video conference with MD
- Non-CPAP (n=62)
  - General measures
- AutoPAP (n=32)
  - with wireless data transmission
- Phone and/or video conference follow-up with nurse at 3, 6, 12 weeks
  - Custom designed web page (FAQs and Q’s)

3-month assessment: All patients: Sleep, quality of life and satisfaction questionnaires; Participants on CPAP: symptoms, CPAP side effects and adherence

Mean CPAP adherence:
- Telemedicine pathway 5.68 ± 1.38 hours/day
- In-person pathway 5.63 ± 1.64 hours/day

<table>
<thead>
<tr>
<th>Functional outcomes of telemedicine versus in-person pathway</th>
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<tbody>
<tr>
<td><strong>LS mean difference (telemedicine minus in-person)</strong></td>
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<tr>
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<tr>
<td>Quebec Sleep Q</td>
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<tr>
<td>QSQ Social</td>
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<tr>
<td>EuroQol-SD</td>
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<tr>
<td>EuroQol- VAS</td>
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<tr>
<td>Epworth SS</td>
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</tbody>
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CBT-I delivered by video teleconferencing is not clinically inferior to in-person delivery
Pros and cons of telemedicine management

**Advantages**

- Convenience
  - reduces patient time off from work
  - reduces expense of travel
  - allows staff to telework
- Increased access to care
  - decrease in no-shows
  - care to disabled and rural patients
- Decreased cost

**Disadvantages**

- Limits ability to form an interpersonal relationship with patient
- Inability to perform physical exam
- Compromises training of staff and fellows – loss of the 360 experience
- Patients’ casual approach to remote care and tendency to receive care ‘on-the-fly’
Using HSAT to diagnose sleep apnea in adults with COPD and CHF

Challenges to validating home sleep testing
- Different recording devices
- Different nights
- Different environments

1. Patients with suspected OSA
2. Home sleep study
3. Simultaneous in-lab PSG & PM
### Validation of HSAT in adults with COPD (n = 90)

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
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<tbody>
<tr>
<td>Age (yr)</td>
<td>66.5 ± 7.8</td>
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<tr>
<td>Males, N (%)</td>
<td>80 (89)</td>
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<tr>
<td>BMI (kg/m²)</td>
<td>27.5 ± 5.8</td>
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<tr>
<td>AHI 4% (PSG)</td>
<td>21.2 ± 26.2</td>
</tr>
<tr>
<td>FEV₁/FVC</td>
<td>53.5 ± 12.4</td>
</tr>
<tr>
<td>FEV₁</td>
<td>1.57 ± 0.65</td>
</tr>
<tr>
<td>FEV₁ (% predicted)</td>
<td>54.0 ± 18.4</td>
</tr>
<tr>
<td>FVC (L)</td>
<td>2.90 ± 0.91</td>
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<tr>
<td>FVC (% predicted)</td>
<td>77.8 ± 18.4</td>
</tr>
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</table>

Validation of HSAT in adults with COPD (n = 90)

Table 2—Values for different cutoffs of manually edited AHI 4% measured by Nox-T3_{home} and Nox-T3_{lab} versus PSG.

<table>
<thead>
<tr>
<th></th>
<th>Prevalence</th>
<th>Sensitivity</th>
<th>Exact 95% CI</th>
<th>Specificity</th>
<th>Exact 95% CI</th>
<th>PPV</th>
<th>NPV</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LB</td>
<td>UB</td>
<td>LB</td>
<td>UB</td>
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<tr>
<td><strong>HSAT vs PSG</strong></td>
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<tr>
<td>≥ 5</td>
<td>.64</td>
<td>.95</td>
<td>.85</td>
<td>.99</td>
<td>.78</td>
<td>.60</td>
<td>.91</td>
</tr>
<tr>
<td>≥ 10</td>
<td>.50</td>
<td>.86</td>
<td>.72</td>
<td>.95</td>
<td>.91</td>
<td>.78</td>
<td>.97</td>
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<tr>
<td>≥ 15</td>
<td>.45</td>
<td>.74</td>
<td>.58</td>
<td>.87</td>
<td>.98</td>
<td>.89</td>
<td>1.00</td>
</tr>
<tr>
<td>≥ 30</td>
<td>.28</td>
<td>.58</td>
<td>.37</td>
<td>.78</td>
<td>.98</td>
<td>.91</td>
<td>1.00</td>
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<tr>
<td><strong>PM in-lab vs PSG</strong></td>
<td></td>
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<td></td>
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<tr>
<td>≥ 5</td>
<td>.63</td>
<td>.96</td>
<td>.87</td>
<td>1.00</td>
<td>.84</td>
<td>.67</td>
<td>.95</td>
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<tr>
<td>≥ 10</td>
<td>.49</td>
<td>.95</td>
<td>.84</td>
<td>.99</td>
<td>.98</td>
<td>.88</td>
<td>1.00</td>
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<tr>
<td>≥ 15</td>
<td>.43</td>
<td>.95</td>
<td>.82</td>
<td>.99</td>
<td>.98</td>
<td>.89</td>
<td>1.00</td>
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<tr>
<td>≥ 30</td>
<td>.28</td>
<td>.96</td>
<td>.79</td>
<td>1.00</td>
<td>.98</td>
<td>.91</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Prevalence, sensitivity, specificity, PPV, NPV for different cutoffs of manually edited AHI 4% from Nox-T3_{home} and Nox-T3_{lab} versus the PSG. Scoring of hypopneas on all three types of sleep test required an associated oxygen desaturation event ≥ 4%. AHI = apnea-hypopnea index, CI = confidence interval, LB = lower bound, Nox-T3_{home} = home testing using the Nox-T3 device, Nox-T3_{lab} = in-laboratory portable monitor recording using the Nox-T3 device, NPV = negative predictive value, PPV = positive predictive value, PSG = polysomnography, UB = upper bound.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>58.7 ± 16.3</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td>Male 73 (86.9)</td>
</tr>
<tr>
<td>BMI, kg/m^2</td>
<td>29.4 ± 13.0</td>
</tr>
<tr>
<td>AH1 4% (PSG), events/hr</td>
<td>23.8 ± 21.3</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>40.3 ± 11.5</td>
</tr>
<tr>
<td>LVEF &lt; 50% (% of participants)</td>
<td>71 (84.5)</td>
</tr>
<tr>
<td>COPD, N (%)</td>
<td>11 (13.1)</td>
</tr>
</tbody>
</table>

AHI on HSAT and on simultaneous in-lab portable monitor and PSG in adults with chronic heart failure

Events on HSAT vs simultaneous in-lab portable monitor and PSG in adults with chronic heart failure

Cheyne-Stokes respiratory pattern during simultaneous in-lab portable monitor and PSG recordings

Remotely monitoring PAP results – Store & Forward

Manufacturer’s website

Clinician

Patient-facing website
Does giving patients access to their CPAP results improve adherence?

195 patients with newly diagnosed OSA (AHI ≥ 15)

Randomized (n=139)

Usual care (n=53) → 3-month visit (n=52)

Web-based access + $$ incentive (n=40) → 3-month visit (n=39)

Web-based access (n=46) → 3-month visit (n=45)

Kuna ST et al. Sleep 2015: 38;1229-36.
Percentage of participants accessing the website each day to view their CPAP data

Kuna ST et al. Sleep 2015: 38;1229-36.
Web-based platform to acquire information from the patient about symptoms and outcomes

- Standardized history and sleep study results
- Wireless CPAP data

Electronic Medical Record

Patient centered outcomes
REVAMP is an interactive Veteran and provider-facing web-based application designed to facilitate the remote diagnosis and management of OSA.

**Veteran**
- Complete questionnaires from home
- View PAP device data
- Access OSA education
- Secure messages to practitioner

**Practitioner**
- Remotely collect and review questionnaires
- Generate templated progress notes
- One-stop shop for PAP data
- Develop reports

Mobile.va.gov/app/revamp-clinicians
Mobile.va.gov/app/revamp-veterans
VA medical centers with REVAMP
REVAMP metrics: Cumulative enrolled and logons

Accounts created: 12,617
Veteran logs on (37%): 4,731
REVAMP metrics: Veterans viewing PAP results - cumulative

PAP data on REVAMP

Veteran viewed PAP results (25%)
Barriers to implementation and acceptance of REVAMP

• REVAMP housed within VA firewall to ensure patient privacy and security
  – Requires patients having a MyHealtheVet premium account – restricting access
  – VA approval regulations delayed platform development
• Platform not connected to the VA electronic medical record
  – Requires double entry of results by clinicians
  – No workload credit for effort spent using REVAMP
• Funding challenges
• VA prefers to buy rather than make
The Office of Rural Health TeleSleep program: Expansion of the hub-spoke model

- Sites with no sleep program
- Patients in rural areas
- Disabled patients

Sleep Center

- Primary care clinics
- Non-MD practitioners
- Video teleconference clinics
- Home sleep apnea testing
- AutoCPAP with wireless data
- Web-based platform management
The Office of Rural Health TeleSleep program for rural veterans with sleep disorders

Spoke sites of Philadelphia VAMC’s TeleSleep program

- St Cloud VAMC: 1230 miles
- Iron Mountain VAMC: 1052 miles
- Canandaigua VAMC: 294 miles
- Bath VAMC: 250 miles
Resume of in-person clinic visits – especially for initial evaluation and PAP set-up

Retain telemedicine-based pathways for delivery of CBT-I and OSA management to increase access, continue telework, decrease cost

Reliance on cloud-based platforms that are integrated with the electronic health record for sleep testing/scoring and collection of questionnaires and patient information

Development of high-performance sleep disorder networks to deliver efficient, cost effective care

Increased reliance on non-physician sleep specialists and primary care providers to deliver routine care to patients with OSA and chronic insomnia

Likely development of new technologies that disrupt our clinical practice

The secret of change is to focus all of your energy, not on fighting the old, but on building the new (Socrates)
And, when you can't go back, you have to worry only about the best way of moving forward.

-Paulo Coelho